

**What Is Claimed Is:**

1. A measuring circuit which measures a parameter of a time-base error of a pulse train, the measuring circuit comprising:

a phase-locked loop including a phase comparator and a variable frequency oscillator, wherein the phase comparator compares phases of an inputted pulse train and a clock signal based on an oscillation output of the variable frequency oscillator to output a phase error signal, and wherein an oscillation frequency of the variable frequency oscillator is variably controlled in correspondence with the phase error signal so as to allow the clock signal to be synchronized with the pulse train;

an absolute value circuit which determines absolute values of phase errors consecutively outputted from the phase comparator; and

an average value circuit which determines an average value of the absolute values of the phase errors which are consecutively determined, or which determines a value corresponding to the average value,

wherein the value determined by the average value circuit is outputted as a measured value of a parameter of a time-base error of the pulse train.

2. The measuring circuit according to claim 1, wherein the average value circuit determines an average

3 value of the absolute values of the phase errors at  
4 all edges of the pulse train, or determines a value  
5 corresponding to the average value.

1 3. The measuring circuit according to claim 1,  
2 wherein the average value circuit includes an  
3 accumulator which consecutively accumulates the  
4 absolute values of the phase errors, and which  
5 determines an accumulated value within a predetermined  
6 time duration as the value corresponding to the average  
7 value of the absolute values of the phase errors.

1 4. The measuring circuit according to claim 2,  
2 wherein the average value circuit includes an  
3 accumulator which consecutively accumulates the  
4 absolute values of the phase errors, and which  
5 determines an accumulated value within a predetermined  
6 time duration as the value corresponding to the average  
7 value of the absolute values of the phase errors.

1 5. An optical disk recording apparatus, comprising:  
2 a measuring circuit which measures a parameter  
3 of a time-base error of a pulse train, the measuring  
4 circuit comprising:

5 a phase-locked loop including a phase  
6 comparator and a variable frequency oscillator, wherein  
7 the phase comparator compares phases of an inputted

8 pulse train and a clock signal based on an oscillation  
9 output of the variable frequency oscillator to output  
10 a phase error signal, and wherein an oscillation  
11 frequency of the variable frequency oscillator is  
12 variably controlled in correspondence with the phase  
13 error signal so as to allow the clock signal to be  
14 synchronized with the pulse train;

15 an absolute value circuit which  
16 determines absolute values of phase errors  
17 consecutively outputted from the phase comparator;  
18 and

19 an average value circuit which  
20 determines an average value of the absolute values  
21 of the phase errors which are consecutively determined,  
22 or which determines a value corresponding to the average  
23 value,

24 wherein the value determined by the  
25 average value circuit is outputted as a measured value  
26 of a parameter of a time-base error of the pulse train;

27 a beam-power adjusting circuit which adjusts  
28 recording beam power of a laser beam; and

29 a control circuit which controls such that test  
30 recording is effected with respect to an optical disk  
31 while consecutively varying the recording beam power  
32 of the laser beam prior to the recording of the optical  
33 disk, the test recording is reproduced after the test  
34 recording, a value of the parameter of the time-base

35 error of the reproduced pulse train is measured by  
36 the measuring circuit, an appropriate value of the  
37 recording beam power of the laser beam during actual  
38 recording is determined on the basis of the measured  
39 value, and the recording beam power of the laser beam  
40 is set to the appropriate value so as to effect actual  
41 recording.

1 6. The optical disk recording apparatus according  
2 to claim 5, further comprising:

3 a pulse-train reproducing circuit which  
4 reproduces a pulse train corresponding to a recording  
5 laser-beam drive signal from a return-light reception  
6 signal of the recording laser beam,

7 wherein, during actual recording, the control  
8 circuit controls such that the value of the parameter  
9 of the time-base error of the pulse train reproduced  
10 by the pulse-train reproducing circuit is measured  
11 by the measuring circuit, and the recording beam power  
12 of the laser beam is consecutively corrected to an  
13 appropriate value in real time on the basis of the  
14 measure value.

1 7. The optical disk recording apparatus according  
2 to claim 5, wherein the average value circuit determines  
3 an average value of the absolute values of the phase  
4 errors at all edges of the pulse train, or determines

5 a value corresponding to the average value.

1 8. The optical disk recording apparatus according  
2 to claim 5, wherein the average value circuit includes  
3 an accumulator which consecutively accumulates the  
4 absolute values of the phase errors, and which  
5 determines an accumulated value within a predetermined  
6 time duration as the value corresponding to the average  
7 value of the absolute values of the phase errors.

1 9. The optical disk recording apparatus according  
2 to claim 7, wherein the average value circuit includes  
3 an accumulator which consecutively accumulates the  
4 absolute values of the phase errors, and which  
5 determines an accumulated value within a predetermined  
6 time duration as the value corresponding to the average  
7 value of the absolute values of the phase errors.

1 10. A measuring circuit which measures a parameter  
2 of the time-base error of a pulse train, the measuring  
3 circuit comprising:

4 a phase-locked loop including a phase comparator  
5 and a variable frequency oscillator, wherein the phase  
6 comparator compares phases of an inputted pulse train  
7 and a clock signal based on an oscillation output of  
8 the variable frequency oscillator to output a phase  
9 error signal, and wherein an oscillation frequency

10 of the variable frequency oscillator is variably  
11 controlled in correspondence with the phase error  
12 signal so as to allow the clock signal to be synchronized  
13 with the pulse train; and

14 an average value circuit which determines an  
15 average value of phase errors consecutively outputted  
16 from the phase comparator, or which determines a value  
17 corresponding to the average value,

18 wherein the value determined by the average value  
19 circuit is outputted as a measured value of the parameter  
20 of the time-base error of the pulse train.

1 11. The measuring circuit according to claim 10,  
2 wherein the average value circuit includes an  
3 accumulator which consecutively accumulates the phase  
4 errors, and which determines an accumulated value  
5 within a predetermined time duration as the value  
6 corresponding to the average value of the phase errors.

1 12. The measuring circuit according to claim 10,  
2 wherein the pulse train has a signal representing  
3 digital information on the basis of its pulse length,  
4 and the measuring circuit further comprises:

5 a pulse-length discriminating circuit which  
6 discriminates a pulse length of one of a  
7 pit-corresponding pulse and a blank-corresponding  
8 pulse of the pulse train,



1 15. The measuring circuit according to claim 14,  
2 wherein the average value circuit includes an  
3 accumulator which consecutively accumulates the phase  
4 errors, and which determines an accumulated value  
5 within a predetermined time duration as the value  
6 corresponding to the average value of the phase errors.

1 16. An optical disk recording apparatus, comprising:

2 a measuring circuit which measures a parameter  
3 of the time-base error of a pulse train, the measuring  
4 circuit comprising:

5 a phase-locked loop including a phase  
6 comparator and a variable frequency oscillator, wherein  
7 the phase comparator compares phases of an inputted  
8 pulse train and a clock signal based on an oscillation  
9 output of the variable frequency oscillator to output  
10 a phase error signal, and wherein an oscillation  
11 frequency of the variable frequency oscillator is  
12 variably controlled in correspondence with the phase  
13 error signal so as to allow the clock signal to be  
14 synchronized with the pulse train; and

15 an average value circuit which  
16 determines an average value of phase errors  
17 consecutively outputted from the phase comparator,  
18 or which determines a value corresponding to the average  
19 value,

20 wherein the value determined by the



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21         average value circuit is outputted as a measured value
22         of the parameter of the time-base error of the pulse
23         train;

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24           a time-base correcting circuit which corrects  
25           a time base of a recording laser-beam drive signal;  
26           and

27           a control circuit which controls such that an  
28       amount of time-base correction of the recording  
29       laser-beam drive signal is set to a predetermined  
30       tentative value prior to recording of an optical disk,  
31       test recording is effected with respect to the optical  
32       disk while consecutively varying the recording beam  
33       power of the laser beam, the test recording is reproduced  
34       after the test recording, a value of the parameter  
35       of the time-base error of the reproduced pulse train  
36       is measured by the measuring circuit with respect to  
37       the test recording recorded with appropriate beam power,  
38       the amount of time-base correction of the recording  
39       laser-beam drive signal during actual recording is  
40       determined on the basis of the measured value, and  
41       the amount of time-base correction of the recording  
42       laser-beam drive signal is set to the value so as to  
43       effect actual recording.

1        17. The optical disk recording apparatus according  
2        to claim 16, wherein the average value circuit includes  
3        an accumulator which consecutively accumulates the

phase errors, and which determines an accumulated value within a predetermined time duration as the value corresponding to the average value of the phase errors.

18. An optical disk recording apparatus, comprising:  
a measuring circuit which measures a parameter  
of the time-base error of a pulse train, the measuring  
circuit comprising:

a phase-locked loop including a phase comparator and a variable frequency oscillator, wherein the phase comparator compares phases of an inputted pulse train and a clock signal based on an oscillation output of the variable frequency oscillator to output a phase error signal, and wherein an oscillation frequency of the variable frequency oscillator is variably controlled in correspondence with the phase error signal so as to allow the clock signal to be synchronized with the pulse train; and

an average value circuit which determines an average value of phase errors consecutively outputted from the phase comparator, or which determines a value corresponding to the average value,

wherein the value determined by the average value circuit is outputted as a measured value of the parameter of the time-base error of the pulse train, and

wherein the pulse train has a signal representing digital information on the basis of its pulse length, and the measuring circuit further comprises:

a pulse-length discriminating circuit which discriminates a pulse length of one of a pit-corresponding pulse and a blank-corresponding pulse of the pulse train,

wherein the average value circuit determines the average value of the phase error at one of a leading edge and a trailing edge of the pit-corresponding pulse, or determines a value corresponding to the average value;

a time-base correcting circuit which corrects a time base of a recording laser-beam drive signal; and

a control circuit which controls such that an amount of time-base correction of the recording laser-beam drive signal is set to a predetermined tentative value prior to recording of an optical disk, test recording is effected with respect to the optical disk while consecutively varying the recording beam power of the laser beam, the test recording is reproduced after the test recording, values of the parameter of the time-base error of the reproduced pulse train are measured for respective pulse lengths by the measuring circuit with respect to the test recording recorded

51 with appropriate beam power, the amounts of time-base  
52 correction of the recording laser-beam drive signal  
53 during actual recording are determined for the  
54 respective pulse lengths on the basis of the measured  
55 values of the parameter of the time-base error, and  
56 the amounts of time-base correction of relevant  
57 portions of the recording laser-beam drive signal are  
58 respectively set to those values so as to effect actual  
59 recording.

1 19. The optical disk recording apparatus according  
2 to claim 18, wherein the average value circuit includes  
3 an accumulator which consecutively accumulates the  
4 phase errors, and which determines an accumulated value  
5 within a predetermined time duration as the value  
6 corresponding to the average value of the phase errors.

1 20. An optical disk recording apparatus, comprising:  
2 a measuring circuit which measures a parameter  
3 of the time-base error of a pulse train, the measuring  
4 circuit comprising:  
5 a phase-locked loop including a phase  
6 comparator and a variable frequency oscillator, wherein  
7 the phase comparator compares phases of an inputted  
8 pulse train and a clock signal based on an oscillation  
9 output of the variable frequency oscillator to output  
10 a phase error signal, and wherein an oscillation



38       a time base of a recording laser-beam drive signal;  
39       and

40           a control circuit which controls such that an  
41       amount of time-base correction of the recording  
42       laser-beam drive signal is set to a predetermined  
43       tentative value prior to recording of an optical disk,  
44       test recording is effected with respect to the optical  
45       disk while consecutively varying the recording beam  
46       power of the laser beam, the test recording is reproduced  
47       after the test recording, values of the parameter of  
48       the time-base error of the reproduced pulse train are  
49       measured for respective pulse lengths by the measuring  
50       circuit with respect to the test recording recorded  
51       with appropriate beam power, the amounts of time-base  
52       correction of the recording laser-beam drive signal  
53       during actual recording are determined for the  
54       respective pulse lengths on the basis of the measured  
55       values of the parameter of the time-base error, and  
56       the amounts of time-base correction of relevant  
57       portions of the recording laser-beam drive signal are  
58       respectively set to those values so as to effect actual  
59       recording.

21. The optical disk recording apparatus according to claim 20, wherein the average value circuit includes an accumulator which consecutively accumulates the phase errors, and which determines an accumulated value

5 within a predetermined time duration as the value  
6 corresponding to the average value of the phase errors.

1 22. A measuring circuit which measures a parameter  
2 of a time-base error of a pulse train, the measuring  
3 circuit comprising:

4 a phase-locked loop including a phase comparator  
5 and a variable frequency oscillator, wherein the phase  
6 comparator compares phases of an inputted pulse train  
7 and a clock signal based on an oscillation output of  
8 the variable frequency oscillator to output a phase  
9 error signal, and wherein an oscillation frequency  
10 of the variable frequency oscillator is variably  
11 controlled in correspondence with the phase error  
12 signal so as to allow the clock signal to be synchronized  
13 with the pulse train;

14 an absolute value circuit which determines  
15 absolute values of phase errors consecutively outputted  
16 from the phase comparator;

17 a first average value circuit which determines  
18 an average value of the absolute values of the phase  
19 errors which are consecutively determined, or which  
20 determines a value corresponding to the average value;  
21 and

22 a second average value circuit which determines  
23 an average value of phase errors consecutively  
24 outputted from the phase comparator, or which

25 determines a value corresponding to the average value,  
26 wherein the values determined by the first average  
27 value circuit and the second average value circuit  
28 are respectively outputted as measured values of first  
29 and second parameters of the time-base error of the  
30 pulse train.

1 23. An optical disk recording apparatus, comprising:  
2 a measuring circuit which measures a parameter  
3 of a time-base error of a pulse train, the measuring  
4 circuit comprising:  
5 a phase-locked loop including a phase  
6 comparator and a variable frequency oscillator, wherein  
7 the phase comparator compares phases of an inputted  
8 pulse train and a clock signal based on an oscillation  
9 output of the variable frequency oscillator to output  
10 a phase error signal, and wherein an oscillation  
11 frequency of the variable frequency oscillator is  
12 variably controlled in correspondence with the phase  
13 error signal so as to allow the clock signal to be  
14 synchronized with the pulse train;  
15 an absolute value circuit which  
16 determines absolute values of phase errors  
17 consecutively outputted from the phase comparator;  
18 a first average value circuit which  
19 determines an average value of the absolute values  
20 of the phase errors which are consecutively determined,



21 or which determines a value corresponding to the average  
22 value; and

23 a second average value circuit which  
24 determines an average value of phase errors  
25 consecutively outputted from the phase comparator,  
26 or which determines a value corresponding to the average  
27 value,

28 wherein the values determined by the  
29 first average value circuit and the second average  
30 value circuit are respectively outputted as measured  
31 values of first and second parameters of the time-base  
32 error of the pulse train;

33 a beam-power adjusting circuit which adjusts  
34 recording beam power of a laser beam;

35 a time-base correcting circuit which corrects  
36 time base of a recording laser-beam drive signal; and

37 a control circuit which controls such that an  
38 amount of time-base correction of the recording  
39 laser-beam drive signal is set to a predetermined  
40 tentative value prior to recording of an optical disk,  
41 test recording is effected with respect to the optical  
42 disk while consecutively varying the recording beam  
43 power of the laser beam, the test recording is reproduced  
44 after the test recording, a value of the first parameter  
45 of the time-base error of the reproduced pulse train  
46 is measured by the measuring circuit, an appropriate  
47 value of the recording beam power of the laser beam

48 during actual recording is determined on the basis  
49 of the measured value, a value of the second parameter  
50 of the time-base error of the reproduced pulse train  
51 is measured by the measuring circuit with respect to  
52 the test recording recorded with appropriate beam power,  
53 the amount of time-base correction of the recording  
54 laser-beam drive signal during actual recording is  
55 determined on the basis of the measured value, the  
56 recording beam power of the laser beam is set to the  
57 appropriate value, and the amount of time-base  
58 correction of the recording laser-beam drive signal  
59 is set to the value so as to effect actual recording.

1 24. A measuring circuit for measuring a parameter  
2 of a time-base error of a pulse train, the measuring  
3 circuit comprising:

4 a phase-locked loop including:

5 variable frequency oscillating means, and  
6 phase comparing means for comparing phases  
7 of an inputted pulse train and a clock signal based  
8 on an oscillation output of the variable frequency  
9 oscillating means to output a phase error signal,

10 wherein an oscillation frequency of the variable  
11 frequency oscillating means is variably controlled  
12 in correspondence with the phase error signal so as  
13 to allow the clock signal to be synchronized with the  
14 pulse train;

absolute value determining means for determining absolute values of phase errors consecutively outputted from the phase comparing means; and

average value determining means for determining an average value of the absolute values of the phase errors which are consecutively determined, or determining a value corresponding to the average value,

wherein the value determined by the average value determining means is outputted as a measured value of a parameter of a time-base error of the pulse train.

25. A measuring circuit for measuring a parameter of the time-base error of a pulse train, the measuring circuit comprising:

a phase-locked loop including:

variable frequency oscillating means, and phase comparing means for comparing phases of an inputted pulse train and a clock signal based on an oscillation output of the variable frequency oscillating means to output a phase error signal,

wherein an oscillation frequency of the variable frequency oscillating means is variably controlled in correspondence with the phase error signal so as to allow the clock signal to be synchronized with the pulse train; and

average value determining means for determining an average value of phase errors consecutively

17        outputted from the phase comparing means, or  
18        determining a value corresponding to the average value,  
19        wherein the value determined by the average value  
20        determining means is outputted as a measured value  
21        of the parameter of the time-base error of the pulse  
22        train.

1        26. A measuring circuit for measuring a parameter  
2        of a time-base error of a pulse train, the measuring  
3        circuit comprising:

4            a phase-locked loop including:  
5                variable frequency oscillating means, and  
6                phase comparing means for comparing phases  
7        of an inputted pulse train and a clock signal based  
8        on an oscillation output of the variable frequency  
9        oscillating means to output a phase error signal,

10            wherein an oscillation frequency of the variable  
11            frequency oscillating means is variably controlled  
12            in correspondence with the phase error signal so as  
13            to allow the clock signal to be synchronized with the  
14            pulse train;

15            absolute value determining means for determining  
16            absolute values of phase errors consecutively outputted  
17            from the phase comparing means;

18            first average value determining means for  
19            determining an average value of the absolute values  
20            of the phase errors which are consecutively determined,

21 or determining a value corresponding to the average  
 22 value; and  
 23 second average value determining means for  
 24 determining an average value of phase errors  
 25 consecutively outputted from the phase comparing means,  
 26 or determining a value corresponding to the average  
 27 value,  
 28 wherein the values determined by the first average  
 29 value determining means and the second average value  
 30 determining means are respectively outputted as  
 31 measured values of first and second parameters of the  
 32 time-base error of the pulse train.